

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during June, 1923.

TEMPERATURE (°C.).

Altitude, m. s. l. (meters).	Broken Arrow, Okla. (233 meters.)		Drexel, Nebr. (396 meters.)		Due West, S. C. (217 meters.)		Ellendale, N. Dak. (444 meters.)		Groesbeck, Tex. (141 meters.)		Royal Center, Ind. (225 meters.)	
	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.
Surface..	24.8	+0.2	20.7	-0.9	27.1	+0.5	19.8	0.0	26.8	+1.0	23.4	-0.2
250.....	24.7	+0.2	20.7	-0.9	26.7	+0.5	19.6	-0.1	25.7	+0.8	23.1	-0.2
500.....	22.9	+0.4	20.0	-0.9	23.9	+0.5	18.1	+0.1	23.4	+0.4	20.3	-0.3
750.....	21.3	+0.5	18.6	-0.7	21.7	+0.2	18.1	+0.1	21.8	+0.3	18.0	-0.6
1,000.....	19.9	+0.5	17.7	-0.3	19.8	-0.1	16.4	-0.3	20.5	+0.3	16.0	-1.0
1,250.....	18.7	+0.7	16.5	-0.1	17.9	-0.4	15.0	-0.5	19.3	+0.4	14.3	-1.2
1,500.....	17.4	+0.9	15.2	-0.1	16.0	-0.6	13.9	-0.4	18.3	+0.7	12.9	-1.1
2,000.....	14.5	+1.0	12.8	+0.3	12.5	-0.8	11.1	-0.3	16.1	+1.0	10.5	-0.8
2,500.....	11.4	+0.7	10.5	+1.0	9.2	-0.9	8.5	0.0	13.7	+1.2	8.1	-0.4
3,000.....	8.4	+0.7	7.7	+1.2	6.5	-0.7	5.9	+0.2	11.2	+1.2	5.0	-0.7
3,500.....	5.3	+0.7	4.7	+1.5	3.8	-0.3	3.0	+0.2	8.4	+1.1	2.1	-0.9
4,000.....	2.2	+0.6	1.8	+1.9	1.6	+0.3	-0.2	-0.1	5.6	+0.9	-0.9	-1.5
4,500.....	-2.0	-0.4	-1.0	+2.0	-1.0	-0.1	-3.2	+0.1	.....	.....	-4.1	-2.1
5,000.....	.....	.....	-3.8	+2.6	.....	.....	-6.0	+0.1	.....	.....	.....	.....

RELATIVE HUMIDITY (%).

Surface..	77	+3	80	+11	60	-2	69	-3	71	-3	66	+4
250.....	77	+3	80	+11	60	-2	69	-3	71	-3	66	+4
500.....	77	+3	78	+10	64	-2	68	-3	79	+3	71	+7
750.....	77	+3	75	+9	67	0	67	-2	79	+4	74	+8
1,000.....	76	+3	72	+7	69	+1	69	+1	76	+4	74	+7
1,250.....	72	0	72	+7	70	+2	69	+3	72	+3	74	+7
1,500.....	68	-2	72	+9	71	+3	64	0	67	+1	71	+5
2,000.....	66	-1	69	+9	75	+6	61	-1	59	-1	63	+1
2,500.....	64	+5	59	+1	78	+7	54	-5	54	-2	49	-3
3,000.....	60	+5	57	0	73	+5	46	-8	53	+2	48	0
3,500.....	60	+6	56	-1	67	+3	43	-8	52	+3	45	+4
4,000.....	58	+7	51	-5	57	+3	43	-6	52	+4	48	+19
4,500.....	72	+23	52	-1	58	+16	34	-17	.....	.....	52	+25
5,000.....	.....	.....	58	+2	.....	.....	35	-16	.....	.....	.....	.....

TABLE 2.—Free-air resultant winds (m. p. s.) during June, 1923.

Altitude, m. s. l. (Meters).	Broken Arrow, Okla. (233 meters.)				Drexel, Nebr. (396 meters.)				Due West, S. C. (217 meters.)				Ellendale, N. Dak. (444 meters.)				Groesbeck, Tex. (141 meters.)				Royal Center, Ind. (225 meters.)			
	Mean.		5-year mean.		Mean.		5-year mean.		Mean.		3-year mean.		Mean.		6-year mean.		Mean.		5-year mean.		Mean.		5-year mean.	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface..	S. 2° W.	4.2	S. 3° W.	3.8	S. 13° E.	3.3	S. 4° W.	1.7	S. 48° W.	2.4	S. 77° W.	0.8	S. 9° E.	1.7	S. 22° E.	0.4	S. 22° E.	3.9	S. 17° E.	2.9	S. 58° W.	2.6	S. 52° W.	1.3
250.....	S. 2° W.	4.3	S. 4° W.	3.9	S. 13° E.	3.3	S. 4° W.	1.7	S. 48° W.	2.4	S. 77° W.	0.9	S. 9° E.	1.9	S. 22° E.	0.6	S. 22° E.	4.8	S. 16° E.	3.5	S. 57° W.	2.6	S. 51° W.	1.3
500.....	S. 8° W.	5.9	S. 11° W.	5.2	S. 7° E.	5.1	S. 3° W.	2.3	S. 48° W.	2.8	S. 78° W.	1.3	S. 10° E.	1.9	S. 11° E.	0.6	S. 12° E.	4.8	S. 16° E.	4.8	S. 54° W.	3.8	S. 46° W.	2.2
750.....	S. 11° W.	6.6	S. 14° W.	5.9	S. 4° W.	8.3	S. 15° W.	3.5	S. 47° W.	3.4	S. 71° W.	2.0	S. 2° E.	3.3	S. 4° E.	1.3	S. 4° E.	7.2	S. 3° E.	5.2	S. 57° W.	5.6	S. 53° W.	2.9
1,000.....	S. 18° W.	6.5	S. 20° W.	6.1	S. 15° W.	8.5	S. 29° W.	4.1	S. 51° W.	3.6	S. 72° W.	1.9	S. 17° W.	4.1	S. 17° W.	1.8	S. 4° W.	7.1	S. 1° W.	5.5	S. 57° W.	5.7	S. 66° W.	3.4
1,250.....	S. 26° W.	6.2	S. 24° W.	6.1	S. 20° W.	8.8	S. 40° W.	4.3	S. 55° W.	4.4	S. 72° W.	2.3	S. 13° W.	4.4	S. 39° W.	2.2	S. 5° W.	7.6	S. 1° W.	6.0	S. 65° W.	5.5	S. 75° W.	3.7
1,500.....	S. 29° W.	5.9	S. 27° W.	6.2	S. 32° W.	8.6	S. 52° W.	5.0	S. 67° W.	5.4	S. 79° W.	3.2	S. 23° W.	4.6	S. 43° W.	3.6	S. 12° W.	7.2	S. 4° W.	5.4	S. 69° W.	5.9	S. 84° W.	4.1
2,000.....	S. 35° W.	5.7	S. 33° W.	6.3	S. 35° W.	8.6	S. 59° W.	6.0	S. 80° W.	7.3	S. 85° W.	5.1	S. 39° W.	4.5	S. 58° W.	3.5	S. 17° W.	6.9	S. 7° W.	5.1	S. 70° W.	7.7	S. 84° W.	6.2
2,500.....	S. 38° W.	5.7	S. 32° W.	6.4	S. 41° W.	10.5	S. 67° W.	7.1	S. 79° W.	6.1	S. 89° W.	5.1	S. 49° W.	5.6	S. 67° W.	5.3	S. 18° W.	6.3	S. 12° W.	5.1	S. 70° W.	8.6	S. 83° W.	8.2
3,000.....	S. 42° W.	6.5	S. 27° W.	7.4	S. 43° W.	10.8	S. 72° W.	8.5	S. 81° W.	7.8	S. 85° W.	6.8	S. 72° W.	7.6	S. 76° W.	7.3	S. 10° W.	6.3	S. 14° W.	5.4	S. 71° W.	8.8	S. 86° W.	10.2
3,500.....	S. 48° W.	8.2	S. 34° W.	7.8	S. 29° W.	11.3	S. 74° W.	9.1	S. 63° W.	9.7	S. 66° W.	7.8	S. 77° W.	8.7	S. 81° W.	8.4	S. 3° W.	7.6	S. 2° W.	6.4	S. 77° W.	8.8	S. 88° W.	12.3
4,000.....	S. 30° W.	9.8	S. 23° W.	8.1	S. 35° W.	8.4	N. 87° W.	8.2	S. 66° W.	11.9	S. 69° W.	10.1	N. 84° W.	12.3	N. 85° W.	10.5	S. 17° W.	7.2	N. 80° W.	4.5	W.	.....	.....	13.0
4,500.....	S. 32° W.	10.5	S. 46° W.	8.5	S. 16° W.	7.4	N. 77° W.	8.4	W.	17.7	N. 72° W.	12.2	S. 61° W.	9.6	N. 80° W.	12.1	S. 7° W.	7.2	S. 16° E.	9.3	N. 67° W.	11.3	S. 77° W.	7.1
5,000.....	W.	13.6	W.	13.6	N. 45° W.	18.1	N. 52° W.	18.8	.....	.....	.....	.....	N. 23° W.	15.9	N. 64° W.	16.2	.....	.....	N. 22° W.	23.7	N. 22° W.	23.7	.....	23.7

THE WEATHER ELEMENTS.

By P. C. DAY, Meteorologist, in Charge of Division.

PRESSURE AND WINDS.

The atmospheric circulation during June, as in the preceding month, and as may be expected in the warmer months of the year, was without sudden and important variations, and cyclonic and anticyclonic activity were both at a low ebb during much of the month. While the pressure was frequently low over the Mountain and Plateau districts, the cyclonic disturbances originating there were mainly unable to advance far to the eastward on account of rather persistent, though moderate, anticyclonic conditions over the central valleys and southeastern districts.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressure during June, 1923—Continued.

VAPOR PRESSURE (mb.).

Altitude, m. s. l. (meters).	Broken Arrow, Okla. (233 meters.)		Drexel, Nebr. (396 meters.)		Due West, S. C. (217 meters.)		Ellendale, N. Dak. (444 meters.)		Groesbeck, Tex. (141 meters.)		Royal Center, Ind. (225 meters.)	
	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.	Mean.	De- parture from 5-year mean.
Surface..	24.28	+1.27	19.87	+1.82	21.22	+0.16	16.03	-0.78	24.69	+0.31	19.25	+1.01
250.....	24.11	+1.32	19.87	+1.82	20.92	+0.19	15.68	-0.62	24.12	+0.65	19.10	+1.08
500.....	21.66	+1.39	18.57	+1.72	18.80	+0.29	15.68	-0.62	22.58	+1.15	17.20	+1.36
750.....	19.44	+1.22	16.11	+1.37	17.37	+0.41	14.20	-0.10	20.58	+1.18	15.60	+1.14
1,000.....	17.52	+0.98	14.52	+1.07	15.84	+0.38	13.18	+0.33	18.25	+1.05	14.06	+0.77
1,250.....	15.06	+0.24	13.48	+1.26	14.44	+0.34	12.10	+0.57	16.10	+0.84	12.50	+0.35
1,500.....	13.30	+0.09	12.37	+1.51	13.09	+0.33	10.19	-0.02	14.01	+0.67	10.96	+0.01
2,000.....	10.67	+0.39	10.11	+1.47	10.91	+0.44	7.97	-0.26	10.90	+0.52	8.05	-0.11
2,500.....	8.28	+0.85	7.35	+0.49	8.99	+0.47	6.13	-0.51	8.58	+0.32	5.41	-0.02
3,000.....	6.20	+0.76	5.77	+0.21	6.98	+0.35	4.00	-0.98	7.27	+0.73	4.12	+0.30
3,500.....	4.94	+0.63	4.43	-0.05	5.22	+0.21	3.16	-0.86	6.07	+0.73	2.94	+0.62
4,000.....	3.89	+0.53	3.40	-0.23	3.66	+0.40	2.52	-0.80	4.99	+0.56	2.68	+1.91
4,500.....	3.61	+0.96	2.96	+0.19	3.12	+1.04	1.35	-1.42	.....	.....	2.54	+2.36
5,000.....	.....	.....	2.78	+0.55	.....	.....	1.26	-1.41	.....	.....	.....	.....

One of the most important cyclones of the month, though not well defined, but accompanied by widespread precipitation, moved slowly from the western mountain regions eastward to the Atlantic coast during the middle part of the first decade. Heavy falls of rain accompanied this storm locally in the central valleys and parts of the East, though the Southern States had usually only scattered showers. As this disturbance was passing off the North Atlantic coast another rather important cyclone developed over the Southwest, and moved slowly eastward, reaching the Middle and South Atlantic coasts by the 13th. This was likewise attended by widespread precipitation, though the notably heavy falls were confined mainly to the districts from the central Plains eastward. At Wichita, Kans., a 24-hour fall of nearly

7 inches was measured on the morning of the 9th, and Dallas, Tex., had nearly 5 inches on the 10th and 11th, while farther eastward Macon, Ga., reported nearly 7 inches on the same dates.

During the middle period of the month the pressure distribution favored local thunderstorms in widely separated districts. These were rather general over the Missouri Valley and Plains States on the 18th and 19th, and again in the Rocky Mountains and portions of the Great Plains on the 20th to 22d.

An important cyclone from the precipitation standpoint, though the pressure variations were mainly small, moved from the central valleys on the morning of the 27th to the Atlantic coast districts by the 29th. This brought some heavy rains in southern Georgia, northern Florida, and in the many sections of the Ohio and Mississippi Valleys.

The average pressure for the month was mainly below normal from the Great Plains westward and over the more eastern districts of both Canada and the United States. Over a narrow area in the Mississippi Valley, extending from the Gulf to the Canadian boundary, and along the eastern slope of the Rocky Mountains, the average pressure was generally slightly above normal.

The June averages of pressure were mainly less than those for the preceding month, as is usually the case over most northern and western districts, but from the middle and southern Plains eastward the June averages, which usually are higher than those for May, were distinctly so during this month.

High winds frequently accompanied the numerous thunderstorms as may be expected during heated periods, and storms of a tornadic character were reported from several localities, the full details of which appear in the table at the end of this section or in special reports elsewhere in this issue.

The prevailing wind systems of the various sections were not strongly developed, owing to the moderately even distribution of pressure.

TEMPERATURE.

The month opened unseasonably cool over the far West with temperatures below freezing and injurious frosts on the 1st and 2d, over elevated portions of Arizona, Nevada, and Utah. At the same time moderate warmth was the rule over the districts from the Rocky Mountains eastward. By the middle of the first decade temperatures had generally risen to normal in the far West, and they were distinctly above to the eastward.

During the week ended the 12th a rather widespread area extending from southern California northeastward to the Great Lakes and New England had temperatures moderately lower than normal, while in the far Northwest, and from Texas eastward and northeastward to the middle Atlantic coast the averages were above normal. No unusual extremes of temperature were noted during this period.

The week ending June 19 had some sharp temperature changes in the far West, notably on the 13th when freezing weather was reported from Nevada, and by the following morning unseasonably cool weather had overspread much of the country from the Rocky Mountains westward. This condition, in somewhat modified form, persisted during most of the week in the western districts and the average temperatures for that period, as a whole, ranged from 3 to 12 degrees below normal. To the eastward of the Rocky Mountains this week was on the whole warm in the Great Plains, upper Mississippi Valley, and

Great Lakes region, and particularly so over the Dakotas and eastern Montana, where the averages ranged from 6 to 9 degrees above normal. Over the States south of the Ohio and east of the Mississippi, as well as those of the Atlantic coast, except Florida, this week was mainly cooler than normal.

The following week, 18th to 26th, continued cool nearly throughout in the districts to westward of the Rocky Mountains, the lowest temperature ever observed in June being reported from Phoenix, Ariz., on the 21st. To the eastward of the Rockies, however, the week was mainly warm, particularly in the eastern Great Plains, central valleys, and thence to the Middle Atlantic States. In these districts the week was almost continuously warmer and in many sections had longer periods of intense heat than ever before known in June. Many cases of death from heat prostration occurred and farm animals in the fields suffered greatly. In portions of these districts the highest temperatures ever observed in June were recorded, while, as stated above, the lowest in June were being experienced at points in Arizona.

A change to cooler weather set in over the upper Missouri Valley about the middle of the last decade and the last few days of the month were moderately cool over practically all portions of the country east of the Rocky Mountains. In the far West warm weather set in about the 27th and continued at the end of the month.

For the month as a whole the average temperature was above normal over all districts east of the Rocky Mountains save from the lower Mississippi Valley eastward, where moderately cool weather continued as had been the case since February of the present year over most districts east of the Rocky Mountains until the present month. In portions of the Middle Atlantic States and thence to the Great Lakes and upper Mississippi Valley the month was among the warmest of record for June, and in portions of Pennsylvania, New Jersey, and Maryland it was the warmest June of record. To the westward of the Rockies, save over a small area in the far Northwest, the month was nearly constantly cool and in portions of Arizona and California it was the coolest June of record.

Maximum temperatures of 100°, or somewhat higher, were observed in some portions of all the States except in the middle Gulf and near the Lake Superior region.

The highest temperatures were recorded about the 7th and 8th in portions of the east Gulf States; about the 20th to 27th in most other districts east of the Rocky Mountains and near the end of the month in the far West.

The lowest temperatures of the month were reported in the first few days in many portions of the Plateau and Pacific Coast States; about the 6th to 9th in the Dakotas and parts of surrounding States; from the 12th to 15th in the northeastern districts and parts of the far Northwest; on the 17th and 21st in Arizona and generally on the 29th to 30th in the great central valleys and Southeastern States. The readings on the last-mentioned dates were the lowest, or among the lowest, ever observed so late in June in many sections of the middle Mississippi and lower Ohio Valleys and the Southern States.

PRECIPITATION.

Over the districts where rainfall in generous amounts is to be expected in June, there was on the whole no great deficiency over large areas, and the distribution was generally such as to favor agricultural and other interests, save in a few localities.

There was entirely too much rain for current needs over considerable areas in Kansas, Oklahoma, and northern Texas, and great damage to crops and other interests resulted, particularly in Oklahoma. In portions of the Middle and East Gulf States there was likewise a marked excess in precipitation, which, following the heavy rains of the preceding month, caused material loss or damage to crops.

On the other hand, there was a marked deficiency in precipitation along the immediate Atlantic coast from Florida to Pennsylvania. In portions of this area, particularly in eastern Pennsylvania, the month had the least precipitation for June in 50 years.

In general, precipitation was materially above normal over portions of the middle Gulf States; in the Great Plains, and eastern slopes of the Rocky Mountains, where at points in northern Texas the precipitation was the greatest ever reported in June; and in the Northern Plateau, where, in some localities, notably in northern Nevada, the total fall for the month was likewise the greatest for June of record. In the western Canadian Provinces, particularly those immediately to northward of Montana, the precipitation for the month was unusually heavy, some stations reporting nearly 5 inches in excess of the normal. In the west Gulf States there was a marked deficiency, and in the Great Lakes region and upper Mississippi Valley a moderate deficiency existed.

As is usual in summer, the precipitation was mostly the result of thunderstorms, and on account of their frequent local nature the monthly precipitation varied greatly within narrow limits. Some of these variations

by States are extraordinarily large, notably in Alabama the monthly precipitation ranged from 14.07 to 1.23 inches; Texas, from 11.81 to 0.00; New Mexico, from 12.31 to 0.00; and North Dakota, from 10.27 to 0.91.

SNOWFALL.

In the high mountains of California snow fell on the 15th and 16th; Tamarack, elevation 8,000 feet, reporting 9 inches, and Lake Tahoe, elevation 6,230 feet, 4 inches; and more or less snow was reported also from the high ranges of Nevada, Utah, Oregon, and in the main ranges of the Rockies.

On account of moderately cool and frequently cloudy weather, snow melting was not so rapid as usual; there was, however, plenty of water for irrigation purposes in California as well as in other districts where a supply of water from melting snow is expected so late in the season.

RELATIVE HUMIDITY.

Atmospheric moisture as expressed by the relative humidity was above normal over the greater part of the country, the excesses being most pronounced in the middle Plains, lower Missouri Valley, and locally in the Central Gulf States and the far West.

Along the Atlantic coast from Georgia to New England and generally over the upper Ohio drainage area and the Great Lakes region the relative humidity was well below the normal, and portions of the Rocky Mountain and Plateau States likewise has less than normal.

SEVERE LOCAL STORMS, JUNE, 1923.

[The table herewith contains such data as have been received concerning several local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau.]

Place.	Date.	Time.	Width of path (yards).	Loss of life.	Value of property destroyed.	Character of storm.	Remarks.	Authority.
Cheyenne, Wyo.....	2	P. m.....	3 to 14.....		\$200	2 tornadoes.....	Barn and many fences damaged.....	Official, U. S. Weather Bureau.
Carlisle, Pa.....	3					Thunderstorm.....	Trees and poles blown down. Some injury to crops by hail.	Do.
Fort Wayne, Ind.....	5	P. m.....		1		Electrical and wind.	Between 600 and 800 telephones out of commission. Power plants damaged.	Do.
Hartford, Conn.....	6	do.....				Thunderstorm.....	Telephone service crippled; light and power lines damaged and a number of buildings struck by lightning. Tobacco crop injured by hail.	Do.
Eastern Washington.....	6	do.....				Electrical and rain.	Poles blown down, lighting service cut off; telephone service crippled.	Spokesman Review (Spokane, Wash.).
New York, N. Y., and vicinity.	6	4 p. m.....		1		Wind.....	Trees uprooted and buildings damaged. Many cellars flooded.	Times (New York).
Hoxie and Walnut Ridge, Ark.	6				1,500	do.....	Considerable property damage.....	Official, U. S. Weather Bureau.
Roswell, N. Mex.....	8	P. m.....			10,000	Tornado.....	Several houses, barns, and outbuildings destroyed.	Do.
Macon, Ga.....	10	do.....				Wind and rain.....	Damage to merchandise, dwellings and streets estimated at thousands of dollars.	Do.
South central Kansas.....	14	do.....		1		do.....	Town of Peck devastated, other villages damaged. Several persons injured.	Wichita Eagle (Kans.).
San Juan Basin, Colo.....	16-17					Wind and sand.....	Houses and barns unroofed; trees uprooted and highways blocked.	Post (Denver, Colo.).
Fond Du Lac, Wis.....	18				8,000	Wind and electrical.	Many tents destroyed and buildings at fair grounds damaged.	Wisconsin State Journal (Madison, Wis.).
Tallula, Ill.....	18	P. m.....			50,000	Wind and hail.....	Heavy damage to buildings and crops.....	Official, U. S. Weather Bureau.
Pittsburgh, Pa.....	19	2 p. m.....				Thunderstorm.....	Oil tank struck by lightning, causing disastrous fire; 14 men injured and 11 families driven from homes.	Do.
Moorhead, Minn.....	22				10,000	Wind and rain.....	Trees, telephone poles, and shop windows damaged.	Do.
Clarksville, Tenn.....	22					Thunderstorm.....	General damage estimated at several thousand dollars.	Do.
Lovell, Wyo.....	22		1,760		5,000	Tornado.....	Details of damage not reported. Path 7 miles long.	Do.
Clymer, Pa.....	23					Wind.....	Six houses damaged.....	Do.
Washington and Frederick Counties, Maryland.	23					Thunderstorms.....	A number of dwellings and barns damaged and trees uprooted.	Do.
New York State (greater portion of).	24				255,000	do.....	Heavy damage, principally to crops.....	Do.
Adams County, N. Dak.	24			7		Tornado.....	Trees and buildings damaged and wires tangled.	Daily News (St. Paul, Minn.).
Springfield, Mass. (vicinity of).	24					Electrical and hail.	Considerable minor damage.....	Official, U. S. Weather Bureau.
Rochester, N. Y.....	25	P. m.....				Wind.....	Considerable damage to trees and wires.....	Do.
Niagara County, N. Y.....	25					Thunderstorms.....	Orchards injured and forest trees blown down.....	Do.
Southern Wisconsin.....	25	P. m.....		1	300,000	do.....	Heavy property damage.....	Do.